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CRUISE RESULTS

NOAA Vessel Miller Freeman, Cruise 90-11
1990 Alaska Fisheries Science Center and
Southwest Fisheries Science Center Cooperative
West Coast Upper Continental Slope Groundfish
Trawl Survey
October 22-November 17, 1990

A comprehensive bottom trawl survey of the groundfish resources of the upper continental slope was completed by Alaska Fisheries Science Center (AFSC) and Southwest Fisheries Science Center (SWFSC) La Jolla and Tiburon Laboratory scientists aboard the NOAA research vessel Miller Freeman between October 22 and November 17, 1990. The survey covered the International North Pacific Fisheries Commission (INPFC) Eureka area, which extends from near Cape Mendocino, California (40°30'N), to Cape Blanco, Oregon (43°00'N). The depth boundaries of the survey were 183-1,280 m (Figure 1). This report summarizes the preliminary results of the survey.

OBJECTIVES

The primary objectives of the 1990 cooperative groundfish trawl survey were:

1. To describe the abundance and distribution of key upper continental slope groundfish species, especially sablefish (Anoplopoma fimbria), Dover sole (Microstomus pacificus), arrowtooth flounder (Atheresthes stomias), and shortspine (Sebastolobus alascanus) and longspine thornyhead (S. altivelis).
2. To obtain extensive biological data, including sex, length, age, length-weight, and maturity, from these species.

Additional projects were conducted to continue studies of juvenile sablefish movements through tagging and to describe



the temperature and salinity characteristics of the slope water column. Tissue samples were collected from the two thornyhead species and Dover sole. These were frozen and stored in liquid nitrogen for studies of the ecological physiology and energetics of slope fishes. Brain tissue and otoliths were collected from shortspine thornyhead for SWFSC (La Jolla) studies to determine if the density of lipofuscin granules in the brain can be used as an independent measure of age. Otoliths were also collected from longspine thornyhead; scientists at the SWFSC (La Jolla) will use thornyhead age data for assessing the status of these recently developing commercial stocks. Researchers from the SWFSC (Tiburon) collected stomach samples from sablefish, Dover sole, shortspine and longspine thornyhead, giant grenadier (Albatrossia pectoralis), and deepsea sole (Embassichthys bathybius) for use in investigations of the trophic relationships of the community.

VESSEL AND GEAR

The research vessel Miller Freeman is a 65.5 m (215 ft) stern trawler equipped with modern trawling, oceanographic and hydrographic sampling systems, and navigation and fishing electronics. The standard survey trawl used was the polyethylene high-opening Noreastern bottom trawl equipped with mud-sweep roller gear constructed of 203 mm (8 in) solid rubber disks strung on 16 mm high tensile chain. Dimensions of this net are: 27.2 m (89 ft) headrope; 37.4 m (123 ft) footrope including the "flying wings"; body constructed of polyethylene mesh; 89 mm stretched mesh codend; and a 32 mm stretched mesh codend liner. Each wing was attached to a 907 kg (2,000 lb), 1.8 x 2.7 m (6 x 9 ft) steel V-door by three 55 m (180 ft) dandyines made of 16 mm galvanized steel cable. A SCANMAR acoustic trawl mensuration system was used to obtain mean fishing dimensions of the Noreastern trawl and a Furuno wireless netsonde system was used to monitor bottom contact throughout each trawl haul.

Water column temperature and salinity profiles were obtained using Seabird CTD probes.

SURVEY DESIGN AND METHODS

The area surveyed was the INPFC Eureka statistical area (40°30'N-43°00'N lat). The survey area was stratified into six depth strata: 183-366, 367-549, 550-732, 733-914, 915-1,097, and 1,098-1,280 m (100-199, 200-299, 300-399, 400-499, 500-599, and 600-699 fm). Trawl station sites were placed randomly along 17 tracklines situated 16.7 km (9 nm) apart in each of the six depth

strata. The number of stations per depth stratum were allocated proportionally to the trackline length across each stratum as follows:

<u>Linear distance along trackline within each depth stratum</u>	<u>Number of stations allocated to each section of trackline</u>
≤7.1 nm (13.0 km)	1
7.1-14.0 nm (13.1-25.9 km)	2
≥14.1 nm (26.1 km)	3

At least one trawl station was assigned to each depth stratum along each trackline.

Stations were surveyed with the ship's fathometer and Loran plotter before and during net deployment. Sampling at each station consisted of a controlled bottom trawl haul with the netsonde attached to the net headrope to monitor bottom contact. A CTD cast was made at predetermined shallow, intermediate, and deep stations on each trackline to obtain temperature and salinity profiles of the slope water column. At depths shallower than 732 m (400 fm) the trawl was towed for 30 minutes using a scope ratio of approximately 2.5:1. Sixty-minute hauls were made at deeper stations using scope ratios of approximately 2:1. Towing speed was approximately 2 knots at all stations and trawling operations occurred 24 hours per day. Trawl mensuration equipment was utilized on all stations shallower than 1,097 m to measure width and height of the trawl while the net was being fished. Station data, including time, position, trawl specifications, distance fished, salinity and temperature profiles, and catch and length information, were stored for later analysis using shipboard computer systems.

All catches were sorted to the lowest possible taxon, weighed, counted, and processed according to standard AFSC and SWFSC protocols. Otolith (age) samples by sex-centimeter category and other biological data were collected from the major fish species encountered. Special study collections were stored in appropriate fixatives or frozen.

RESULTS

One hundred eight predetermined trawl stations were established for this survey. Two stations were abandoned when the ground was determined to be untrawlable. Successful trawl samples were obtained from 102 of the remaining 106 stations. Some stations were moved slightly from the original sites to find suitable terrain for trawling. The four unsuccessful tows resulted in

extensive damage to the net. The 20 most abundant groundfish and crab species taken from successful tows in each depth stratum were ranked in order of catch per unit effort (CPUE) expressed in kg/km trawled

(Table 1). Mean CPUE distributions by depth stratum, relative abundance over all depth strata, and presence or absence in a given depth stratum are shown for the five target groundfish species in Figure 2.

Sablefish was taken each depth stratum and was the third most abundant species (35.9 and 36.4 kg/km) in the 550-732 m and 1,098-1,280 m strata, respectively. Dover sole was taken in all strata and was the most abundant species (47.1 kg/km) in the 550-732 m stratum and was the second, third, or fourth most abundant species in four of the other five depth strata. Longspine thornyhead was taken in all strata except the 183-366 m stratum and was the most abundant species (55.6 and 65.4 kg/km) in the 733-914 m and 915-1,097 m strata. Longspine thornyhead was also the second most abundant species in 550-732 m and 1,098-1,280 m strata. Shortspine thornyhead was taken in all strata and was most abundant (19.3 kg/km) in the 1,098-1,280 m stratum. Shortspine thornyhead was the fifth or sixth most abundant species in four of the other five strata. Arrowtooth flounder was taken in the two shallow strata (eighth and seventeenth) and was most abundant (7.6 kg/km) in the 183-366 m stratum. Grooved Tanner crab was taken in the four deepest strata and was most abundant (20.0 kg/km) in the 550-732 m stratum.

Otoliths and data on individual length, weight, and maturity stage were collected from target species (sablefish, Dover sole, arrowtooth flounder, shortspine and longspine thornyhead). Personnel from the SWFSC Tiburon Laboratory collected 2,106 stomach samples from six slope groundfish species for feeding habits studies. Personnel from the SWFSC La Jolla Laboratory collected 304 tissue and otolith samples from 7 groundfish species and also collected 213 whole juvenile longspine thornyhead for sex and age determination. Ovaries from 200 Pacific hake were obtained by AFSC personnel. In addition, 72 juvenile sablefish were tagged, 54 CTD profiles were obtained, and the centerboard mounted Simrad EK500 transducer was calibrated during the survey. Also, the Acoustic Doppler Current Profiler was used to collect current profiles along a 20 nm transect extending perpendicular to the coast at the northern end of the survey area. Size composition weighted by stratum area for sablefish, Dover sole, shortspine and longspine thornyhead, and arrowtooth flounder over all depth strata are shown in Figure 3. A summary of the biological data collected during the survey is shown in Table 2 and Table 3 summarizes the length frequency data collected from non-target species.

SCIENTIFIC PERSONNEL

Leg I

Paul Raymore	Chief Scientist, AFSC, Seattle
Frank Shaw	AFSC, Seattle
Claire Armistead	AFSC, Seattle
Norman Parks	AFSC, Seattle
William Flerx	AFSC, Seattle
Pam Bell	AFSC, Seattle
Dan Nichol	AFSC, Seattle
Rae Baxter	AFSC, Seattle
Dave Griffith	SWFSC, La Jolla
Kelly Silberberg	SWFSC, Tiburon
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Leg II

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Table 1.--Mean CPUE (kg/km) of the 20 most abundant groundfish and selected crab species caught during the 1990 west coast upper continental slope groundfish survey.

Species name	Stratum 1 183-366 m	Species name	Stratum 2 367-549 m	Species name	Stratum 3 550-732 m	Species name	Stratum 4 733-914 m
Pacific hake	211.1	Pacific hake	178.4	Dover sole	47.1	Longspine thornyhead	55.6
Spiny dogfish	49.9	Spiny dogfish	41.0	Longspine thornyhead	38.4	Dover sole	35.6
Splitnose rockfish	37.2	Dover sole	36.5	Sablefish	35.9	Grooved Tanner crab	14.6
Dover sole	26.2	Sablefish	13.4	Grooved Tanner crab	20.0	Sablefish	12.1
Sablefish	20.4	Rex sole	12.6	Shortspine thornyhead	12.9	Shortspine thornyhead	3.7
Stripetail rockfish	13.5	Shortspine thornyhead	4.6	Giant grenadier	9.7	California slickhead	3.6
Longnose skate	9.3	Aurora rockfish	4.2	Rex sole	5.3	Pacific grenadier	3.6
Arrowtooth flounder	7.6	Brown cat shark	3.9	Pacific hake	3.4	Giant grenadier	3.1
Darkblotched rockfish	6.7	Longnose skate	3.8	Brown cat shark	2.7	Deepsea sole	2.8
Bering skate	6.2	Bigfin eelpout	2.8	Black eelpout	2.0	Brown cat shark	1.3
Rex sole	5.2	Longspine thornyhead	1.6	Twoline eelpout	1.5	Threadfin slickhead	0.7
Spotted ratfish	3.9	Slender sole	1.5	Black skate	1.1	Twoline eelpout	0.7
Lingcod	3.4	Black eelpout	1.5	Longnose skate	0.8	Kamchatka eelpout	0.7
Redbanded rockfish	2.8	Twoline eelpout	1.3	Deepsea sole	0.7	Black hagfish	0.5
Slender sole	2.7	Bering skate	0.9	Pacific grenadier	0.6	Black skate	0.3
Shortspine thornyhead	2.6	Pacific halibut	0.7	California slickhead	0.5	Pacific hake	0.2
Bigfin eelpout	2.2	Arrowtooth flounder	0.7	Spiny dogfish	0.3	Black eelpout	0.2
Chinook salmon	1.6	Petrals sole	0.2	Black hagfish	0.3	Spiny dogfish	0.2
Bocaccio	0.9	Blackgill rockfish	0.2	Longnose lancetfish	0.2	Pacific blacksmelt	0.2
Sharpchin rockfish	0.8	Deepsea sole	0.2	Kamchatka eelpout	0.2	Jack mackerel	0.1
Number of hauls	16	Number of hauls	17	Number of hauls	18	Number of hauls	17
Species name	Stratum 5 915-1,097 m	Species name	Stratum 6 1,098-1,280 m	Species name	All Strata 183-1,280 m		
Longspine thornyhead	65.4	Pacific grenadier	50.4	Pacific hake	48.0		
Pacific grenadier	29.2	Longspine thornyhead	45.6	Longspine thornyhead	39.6		
Dover sole	27.5	Sablefish	36.4	Dover sole	31.3		
Grooved Tanner crab	15.2	Giant grenadier	27.9	Sablefish	22.2		
Sablefish	14.8	Shortspine thornyhead	19.3	Pacific grenadier	15.1		
Shortspine thornyhead	11.3	Grooved Tanner crab	16.2	Grooved Tanner crab	12.5		
Deepsea sole	6.0	Dover sole	12.4	Spiny dogfish	11.1		
California slickhead	5.1	Pacific flatnose	8.7	Shortspine thornyhead	9.5		
Giant grenadier	4.3	Deepsea sole	8.5	Giant grenadier	7.7		
Twoline eelpout	3.0	Black skate	3.7	Splitnose rockfish	4.5		
Black skate	2.6	California slickhead	3.4	Deepsea sole	3.3		
Pacific flatnose	1.8	Twoline eelpout	1.2	Rex sole	3.2		
Kamchatka eelpout	1.1	White skate	0.8	California slickhead	2.5		
Black hagfish	0.5	Deepsea skate	0.3	Pacific flatnose	1.8		
Brown cat shark	0.5	Pacific blacksmelt	0.2	Longnose skate	1.7		
Shortspine combfish	0.5	Pacific hake	0.2	Stripetail rockfish	1.6		
Pacific blacksmelt	0.2	Black hagfish	0.2	Brown cat shark	1.4		
Pacific hake	0.1	Kamchatka eelpout	0.2	Black skate	1.4		
Pacific hagfish	0.1	Jack mackerel	0.1	Twoline eelpout	1.4		
Longfin dragonfish	0.1	Pacific hagfish	0.1	Arrowtooth flounder	1.0		
Number of hauls	17	Number of hauls	17	Number of hauls	102		

Table 2.--Biological data collected during the 1990 West Coast upper continental slope groundfish trawl survey.

Fish species sampled	Otoliths and Maturity Data	Length-Frequency Data	La Jolla Frozen Tissues	La Jolla Skull and otoliths	Tiburon Stomach samples
Arrowtooth flounder	97	423	--	--	---
Dover sole	539	6,672	80	--	364
Sablefish	523	3,153	--	--	536
Shortspine thornyhead	582	3,202	60	60	366
Longspine thornyhead	340	9,754	80	--	364
Giant grenadier	---	1,442	--	--	105
Deepsea sole	---	1,809	37	--	281
Rex sole	---	2,489	21	--	---
Splitnose rockfish	---	1,113	24	--	---
Aurora rockfish	---	320	2	--	---

Table 3.--Length-frequency measurements obtained from non-target species during the 1990 west coast upper continental slope groundfish trawl survey of the INPFC Eureka area.

Fish Taxon	Length-Frequencies
Hagfish	501
Skates	886
Sharks	2,523
Other flatfish	7,813
Other rockfish	2,041
Other grenadiers	3,716
Other roundfish	14,695

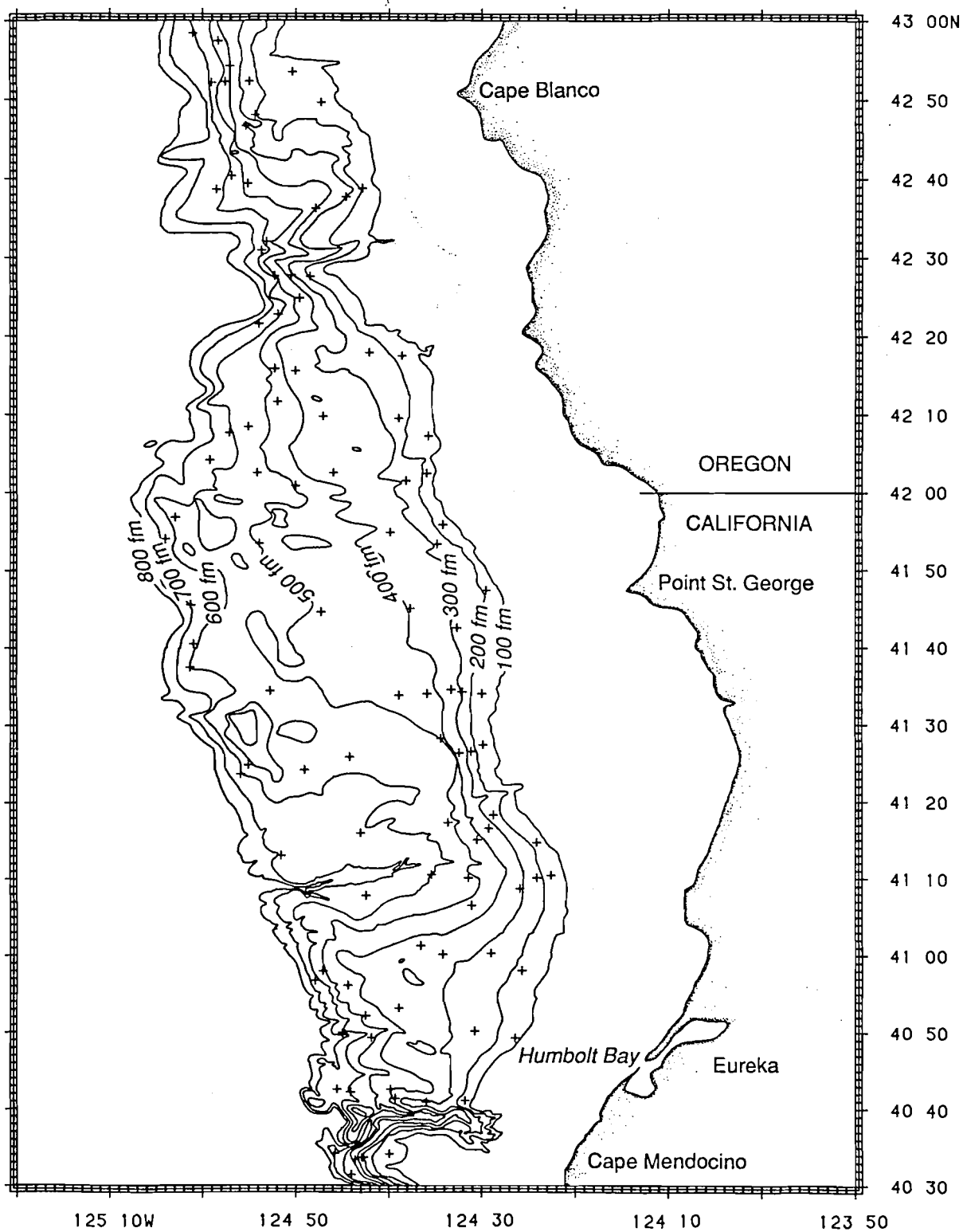
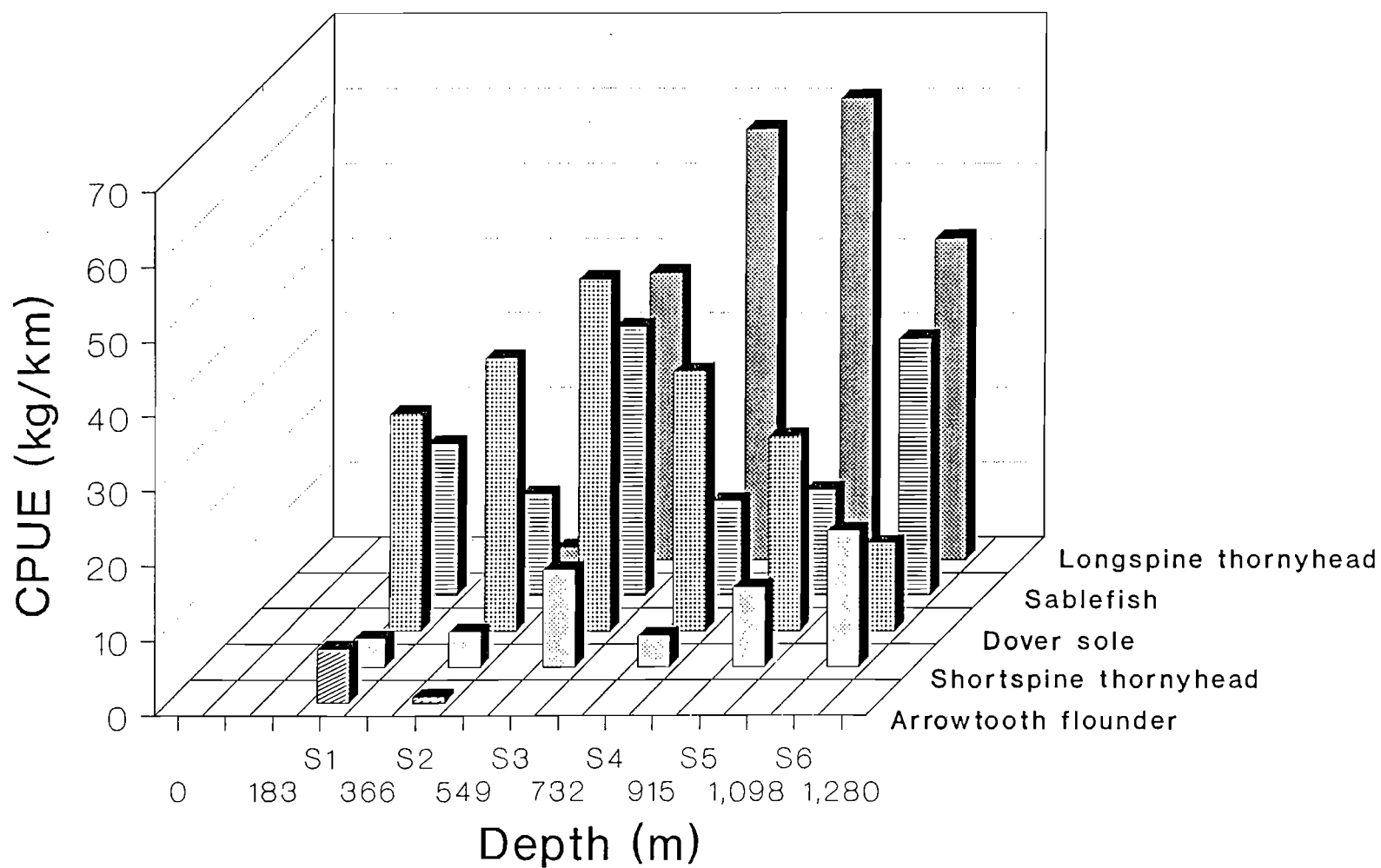


Figure 1.--Survey area showing the locations of the 102 successful tows completed during the 1990 Alaska Fisheries Science Center and Southwest fisheries Science Center cooperative groundfish trawl survey. Equivalent depth intervals are: 183 m = 100 fm, 366 m = 200 fm, 549 m = 300 fm, 732 m = 400 fm, 915 m = 500 fm, 1,098 m = 600 fm, and 1,280 m = 700 fm.

Figure 2.--Summary of the CPUE distributions by depth stratum (S1-S6) for five target groundfish species during the 1990 INPFC Eureka area upper continental slope trawl survey.



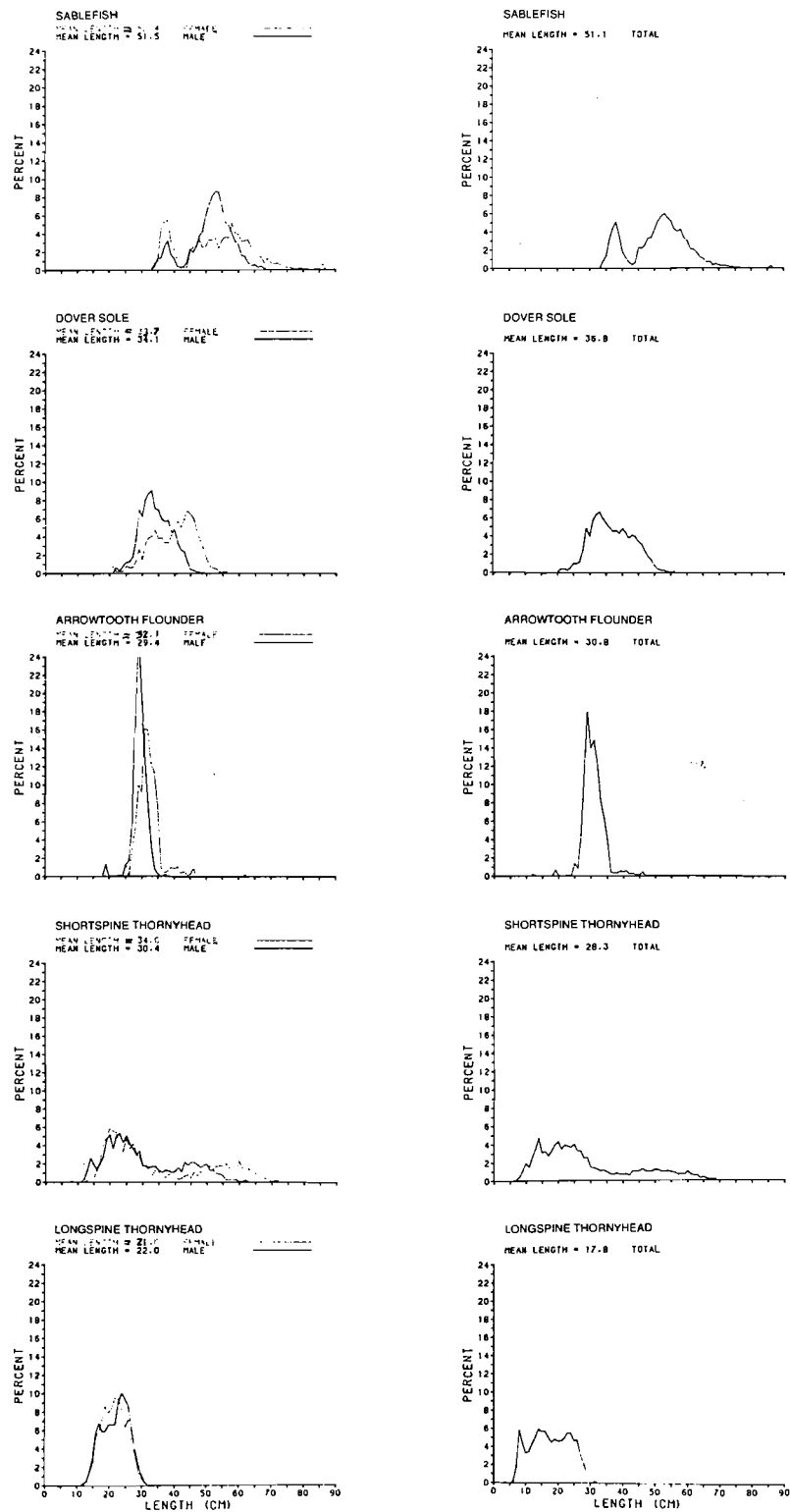


Figure 3.--Size composition (fork length) of primary target species pooled over all depth strata (183-1,280 m). The dark curve on the Female/Male plots represents the male population and the lighter curve represents the female population.